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Interactive Comment

Interactive comment on "Observations of water vapor mixing ratio and flux in Tibetan Plateau" *by* S. Wu et al.

Anonymous Referee #2

Received and published: 22 December 2015

This manuscript describes a water vapor Raman lidar system and some of its measurements in the Tibetan Plateau. The language of the manuscript is unfortunately poor and will require substantial copy editing before being acceptable for publication. But the main problems I have with the manuscript are related to its contents: (1) It contains only insufficient references to the state-of-the-art of lidar. Being probably the ground-based Raman lidar at the site at the highest altitude worldwide, one would expect references to other mountain-based water vapor lidars (Zugspitze and Jungfraujoch in Europe, Mauna Loa in Hawaii, USA, more?). Furthermore, special issues regarding the meteorological conditions and problems regarding the ambient conditions at the ground and how the authors solved these issues are mostly missing and should be discussed in much greater detail. (2) Important information on how the results have been derived is missing at several points. (3) The whole section about the latent heat flux measurements is unclear to me because essential information is missing.

I am very interested in details of this special lidar instrument and its unique observations. Therefore, I would strongly encourage the authors to revise their manuscript in these points. In conclusion, I recommend accepting this manuscript after major revision.

Specific points:

Page 11927, line 8: References to previous intercomparison studies with water vapor lidar systems, e.g., within the IHOP_2002 campaign (Behrendt et al., JTech, 2007a,b) and the COPS campaign (Bhawar et al., QJRMS, 2011) should be included.

Page 11927, line 11: This statement is not true I think. Please revise or add references as proof.

Page 11927, line 17: Please add more recent papers on water vapor DIAL.

Page 11927, line 28: Please add more recent papers on water vapor Raman lidar. Even stratospheric water vapor measurements with Raman lidar have been reported meanwhile.

Page 11928, first paragraph: Please add references for these statements.

Page 11928, line 14: Which type of radiosondes is used?

Page 11928, line 17: Please add references.

Page 11929, second paragraph: Please add references.

Page 11929: Please explain the setup of the lidar (telescope characteristics) at one point and not piece by piece in different paragraphs.

Page 11930, line 14: Is there a risk of temperature sensitivity with using a water vapor filter with such a small bandwidth (Whiteman, Applied Optics, 2003a,b)? Please

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comment and explain why you selected these specifications.

Page 11930: Please explain all parameters used in the equations.

Page 11931 (and elsewhere): Please add references for all equations which are not new and have been taken from prvious publications.

Page 11931, line 14: Please add reference for this statement.

Page 11931, equation 7: Where does the parameter D come from? Does it account for an offset of the radiosonde or the lidar of RS? Was the lidar data corrected for deadtime effects of the detector? Please comment on these points in the manuscript.

Page 11931, equation 14: Where does this equation come from? Commonly, latent heat flux measurements with a combination of water vapor lidar and Doppler lidar (all references to previous publications are missing here) are based on correlating vertical wind data and moisture data of the same very high temporal resolution (typically 10 s in order to sample the turbulent processes reasonable well). Here it seems to me that you used data with much lower resolution. Then one would expect that the average vertical wind is zero in the mean. The only exception is found in cases where updrafts are localized due to the orography. Is this the case here? Or did you use wind data with high resolution but moisture data with low resolution? This would be questionable, see comments below regarding Figs. 8 and 9.

Page 11936, equation 15: How large is the blocking of the elastic light in the signal of the Raman channels? If the blocking is too low, elastic signal leakage in the water vapor data will cause a moist bias of the measured data in clouds.

Page 11937: How stable is the lidar calibration in time?

Figure 2: Which heights did you use for the intercomparisons? A distance of 16 km is much too large to expect the same moisture in the convective boundary layer because differences in land-surface properties (soil moisture, vegetation, orography) will cause different surface fluxes. Only comparisons in the free troposphere are acceptable be-

cause the moisture in these heights is dominantly influences by advection. How many days/profiles are used for this plot? What is the temporal and range resolution of the data?

Figure 3: Information on date of the measurements, period, resolution is missing.

Figure 4: Information on date of the measurements, period, resolution is missing. How many days/profiles are used for this plot? What is the temporal and range resolution of the data?

Figure 5: Information on measurement periods and range resolution is missing. What were the launching times of the sondes?

Figure 6: This is no diurnal variation (variation within the course of one or several days related to different daylight conditions). This is the moisture development within the period of several days (how many?). How many profiles have been measured on each day? What are the measurement periods of the lidar (averaging over which times)?

Figure 7: What is new here? Merge with figure 3?

Figures 8 and 9: Are you using a constant water vapor profile here? Then the results would be wrong because also the atmospheric moisture changes when the wind changes.

Figure 8: Is the moisture profile from the lidar? What is the measurement period? What are the error bars? How about incomplete overlap close to the ground?

Technical corrections:

“Lidar” should always be written “lidar”.

Please use even values for the labels of the plots, e.g., for the times in Figs. 8 and 9.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 11925, 2015.